THE TEXAS THUNDERBOLT

NATIONAL WEATHER SERVICE -- FORT WORTH, TX
SERVING ALL OF NORTH TEXAS
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Aviation Forecast for the Arlington Airport Begins

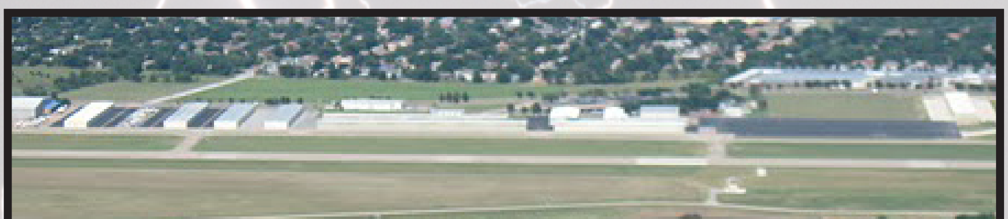
by Dan Shoemaker

On June 8th, NWS Fort Worth began writing Terminal Aerodrome Forecasts (TAFs) for the Arlington Municipal Airport (KGKY). TAFs are a coded aviation forecast of ceiling, visibility, weather, winds, and other airport specific information for pilots and aviation interests. These forecasts are written every 3 hours and amended if weather conditions change. TAFs are valid for a 24 hour period.

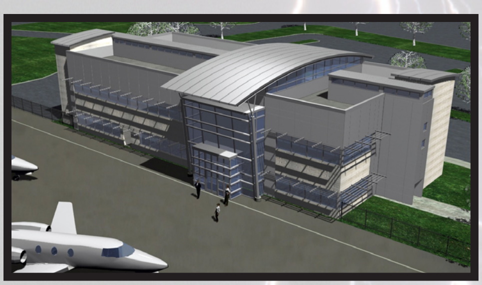
TAF service started at Arlington Municipal because of the airport's rapid growth. Flight operations are expected to surpass 100,000 in 2010 and are projected to be over 130,000 by 2012. Operations include pilot training, fixed base operations (aircraft maintenance, fuel, repair), Bell Helicopter's flight test facility, and air cargo operations. The recent completion of the Dallas Cowboy's stadium has also dramatically increased transient operations on game and event days.

Future airport expansion includes a new terminal (see the artist depictions below), which is expected to open by Thanksgiving. Increased ramp space, which will be available this fall, and a new west taxiway plus additional hangar space are planned for the west side of the runway.

As local airports grow and expand, NWS Fort Worth looks forward to helping them meet their weather needs.



Above:
Aerial view of Arlington Municipal Airport. Photo: Stanley Hinson and Rob Scivally
Below:
Artist depictions of Arlington Municipal expansion. Images: Bob Porter



A New Lightning Nowcasting Tool: Vertically Integrated Ice

by Matt Mosier

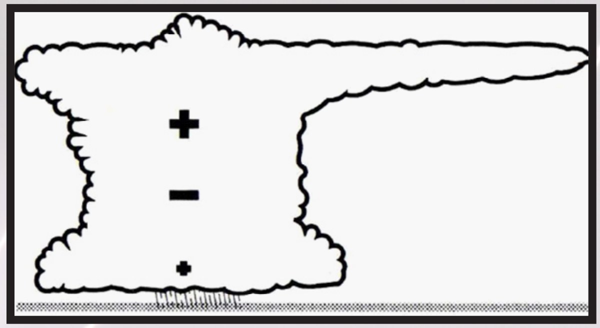
Lightning is the second most deadly thunderstorm-related event, superceded only by flooding. However, predicting the onset of lightning in a shower or thunderstorm is very difficult. The lightning production process in thunderstorms is well understood, but observing the process in real-time is complicated, expensive, and can involve a large team of people. These types of observations are usually done only during research experiments and for a limited period of time. As a result, real-time forecasting of lightning initiation is limited by insufficient observations.

Thunderstorm electrification can happen very quickly, especially in storms that have strong updrafts. The electrification process begins when an updraft is strong enough to carry moisture to a height where the environmental temperature drops below -10°C. At this height, the cooled water droplets begin to interact with previously frozen water particles. As a result of interactions between cooled and frozen particles, electrical fields develop within the storm.

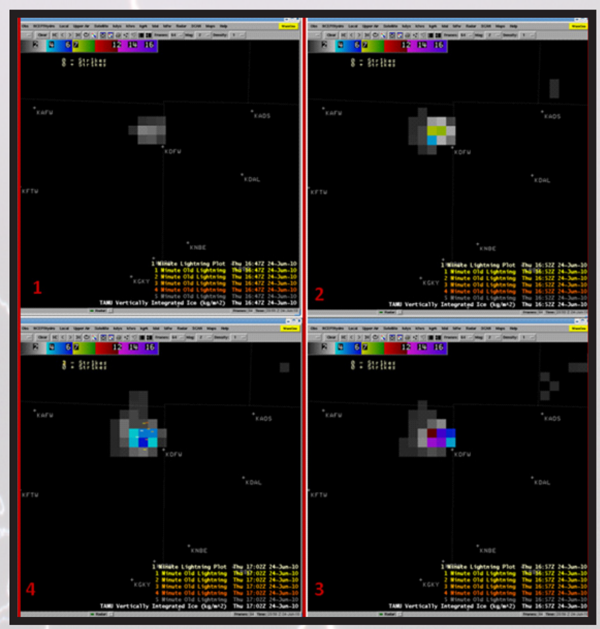
These electrical fields can be seen in the top image to the right. Lightning occurs as a result of the electric potential created by these fields. Therefore, any observational technique used to aid in lightning nowcasting must be able to observe these interactions and processes.

Recent research has developed a technique using weather radar to observe the portion of the storm responsible for thunderstorm electrification. This technique uses the radar returns (reflectivity) between the -10°C and -40°C temperature levels to estimate the "ice mass" in that region.

This product, called Vertically Integrated Ice (VII), can give forecasters an average of 15 minutes lead time before the first cloud-to-ground lightning strike. VII is especially useful for forecasting lightning in the pulse thunderstorms common in summer.



Above:
Dipole/tripole structure of a thunderstorm with an upper and lower positive (+) charge regions and a main negative (-) charge region (from MacGorman and Rust 1998).



Above:
A series of images showing the evolution of the VII values before a cloud-to-ground lightning strike near DFW Airport on June 24, 2010.

Decatur is StormReady!

Above:
John Hudson (left), Emergency Planner for the City of Decatur, with Joe Neil Henderson, Radio Shack.

The City of Decatur became StormReady on May 27, 2010. The StormReady program is a national partnership between local communities and the National Weather Service. StormReady communities are better prepared to save lives from hazardous weather through advanced planning, education, and awareness. In order to become StormReady, a community must have a 24-hr Emergency Operations Center capable of monitoring weather information and have the ability to alert citizens to hazardous weather through avenues such as outdoor warning sirens or automated phone calls. Local officials are also highly encouraged to host and provide access to weather training classes, as well as visit the local NWS office. The StormReady recognition is good for 3 years, at which time the community may reapply.

Radio Shack donated 20 NOAA Weather Radios to the City of Decatur to be used in schools or other public areas. The local Radio Shack store is also the official site to provide weather safety, disaster preparedness, and other safety information to the public. The National Weather Service provided Decatur with 2 StormReady signs, which will be placed near the city limits along Highway 380 and Highway 287.

For More Information on StormReady:
www.stormready.noaa.gov

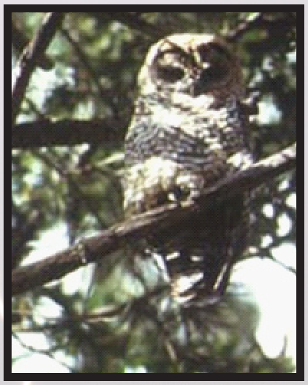
NWS Fort Worth IMET Deployed to Arizona Fire

NWS Fort Worth's Incident Meteorologist (IMET) Joe Harris recently returned from a two week dispatch to the Horseshoe Fire in the Chiricahua Mountain Wilderness Area of southeast Arizona. The fire burned over 3900 acres of very rugged terrain within the wilderness area, and was a threat to the Mexican Spotted Owl nesting habitat.

NWS incident meteorologists are all volunteers and undergo several years of specialized training and mentoring by other incident meteorologists before becoming a certified IMET.

Once on the scene of a fire, the IMET must be prepared to give the Incident Commander a detailed weather briefing for the next several days. With a laptop computer, special weather decoding programs, and sometimes a satellite communications system, the IMET monitors local weather conditions and prepares daily weather forecasts. This information is used to help the safety of the wildland firefighters and the planning of daily firefighting operations.

Above:
IMET Joe Harris stationed at the Horseshoe Fire in Arizona.



Right: Chiricahua Wildlife of Southeast Arizona: (Clockwise from left) Coati Mundi, Mexican Spotted Owl, and the Elegant Torgon

Below:
Horseshoe Fire on June 16, 2010 looking west from the Incident Command Post near Rodeo, New Mexico.

DR. WEATHER'S WISDOM

Hurricanes & Wind Shear

It is common knowledge that hurricanes require warm ocean waters in order to develop, but vertical wind shear is often the other important factor controlling hurricane formation and intensity.

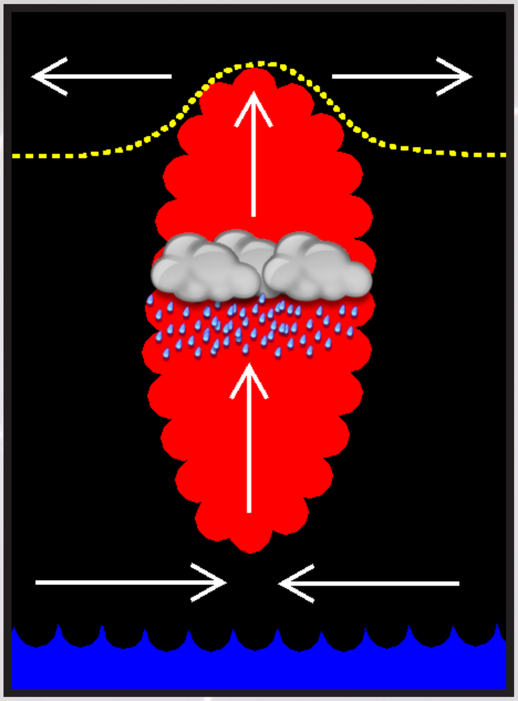
Vertical wind shear is the difference in wind direction and speed at different levels in the atmosphere. Hurricanes require wind shear to be low in order to organize. Too much wind shear can quickly weaken and destroy even a strong, mature system.

To understand the effects of wind shear, let's simplify a hurricane down to its basics:

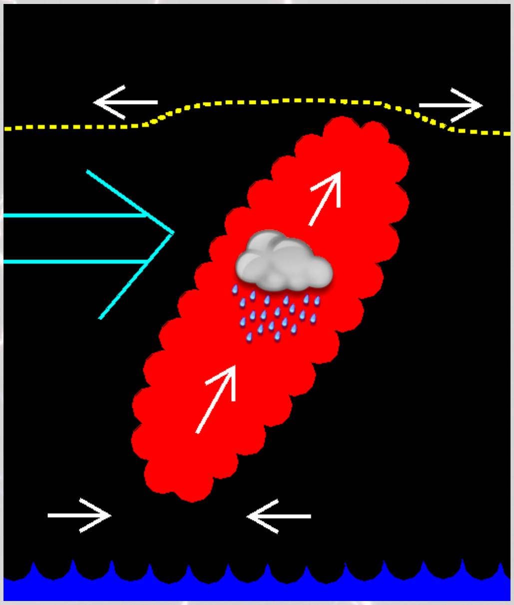
Hurricanes are a special type of low pressure system that derive some of their energy by converting water vapor into liquid water in the form of clouds and rain. The conversion process releases heat energy and causes the temperatures to gradually rise in the center of the hurricane. At the top of the atmosphere, the cumulative effect of this warm air (which can be envisioned as a bubble) creates a "bump" or high pressure area above the hurricane. This upper level high evacuates air that has already released its heat and rainfall from the hurricane like the exhaust from an engine. See the top image at the right.

Hurricanes are often described as giant heat engines because air at the surface spirals into the center of the storm, rises, and releases heat energy (and rain, of course) before being evacuated away at the top of the atmosphere. The more air the hurricane can convert into rain, the more heat that is released, and thus the more pronounced the bubble of warm air becomes. A hurricane will continue to grow stronger provided there is an unlimited supply of warm and moist air to ingest. This ingestion causes the warm air bubble in the core of the hurricane to further intensify.

So how is wind shear tied into this? When wind shear is present, it causes the warm air bubble to lean over (see bottom image at right). This means the high pressure area above the hurricane is weaker. The "bump" a the top of the atmosphere is not nearly as pronounced and it is spread out over a larger area. Without the evacuation of air at the top of the hurricane, the lift needed to draw up air and moisture from the low levels is impaired. The hurricane cannot survive without this core of warm air remaining straight up and down.



Above:
Hurricane with weak wind shear present. Note the column of air (red shading) is straight up and down. Air from the warm "bump" is evacuated at the top of the storm.



Above:
Hurricane with strong wind shear present. The column of air is now leaning. The warm "bump" of air is not as pronounced and spread over a larger area.

How Does Doppler Radar Help Meteorologists Detect Tornadoes?

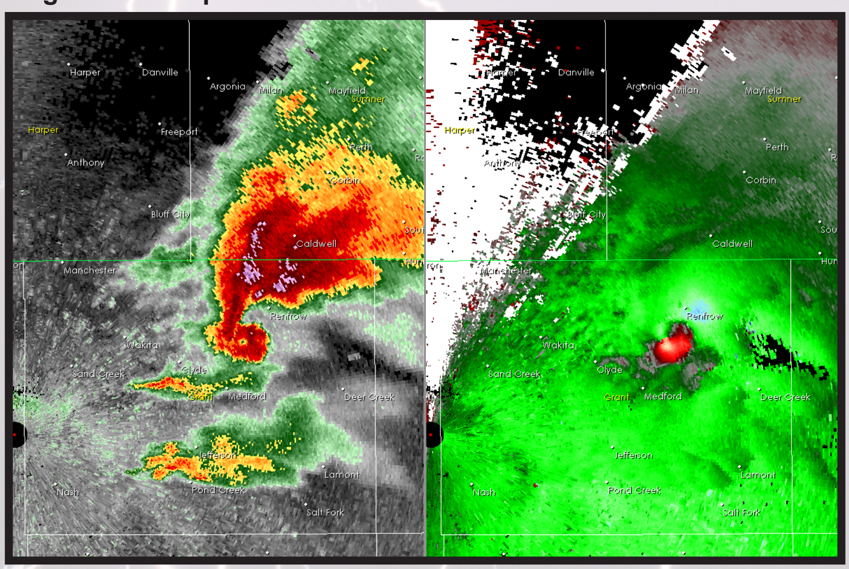
by Jason Dunn

If you have ever watched television meteorologists during severe weather or listened to NOAA Weather Radio, you may have heard the phrase "Doppler radar indicated a tornado" near a certain location. What exactly does that mean? Doppler radar has been around for quite a while, with studies conducted as early as the 1960s on its importance as a severe weather warning tool for meteorologists. In the late 1980s and early 1990s, the National Weather Service began installing the NEXRAD (NEXt generation weather RADar) system throughout the U.S. and its territories.

Above:
Typical NWS NEXRAD.

This system, which is still in use today, is a Doppler radar. Doppler means that not only can the radar detect precipitation, but it can detect the motion of the raindrops within a thunderstorm. This motion is directly related to the wind speed within the storm, and if meteorologists know how the wind is blowing, then rotation and possible tornadoes can be identified.

The NEXRAD system, also known as WSR-88D, sends out very short pulses of energy, which hit precipitation particles (raindrops, cloud droplets) and reflect energy back to the radar. This reflected energy produces a picture for meteorologists to interpret.



Above:
NWS radar display. Image on the left is reflectivity (precipitation) image of a supercell. The image on the right shows the velocity and tornadic rotation of the storm.

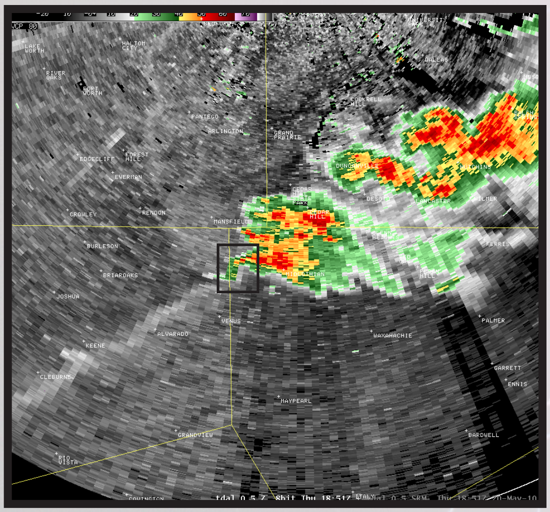
In the radar image above, note the familiar "hook echo" in the precipitation image. This feature is characterized by the hook-like appendage on the southern end of the storm. This feature has long been known to be a favored signature in severe thunderstorms indicating the potential for a tornado. In the velocity, or wind speed image, the green and blue colors indicate precipitation particles moving toward the radar (black circle in the far left of each image is the radar location), while the red colors indicate precipitation moving away from the radar. Meteorologists look for areas where green and red colors are close together, indicating rotation and a potential tornado. If the rotation is strong enough and is located in a favorable area, such as the hook region, a tornado warning may be issued. In the example shown in the images above, the well-defined hook echo and strong rotation was associated with a large tornado in northern Oklahoma.

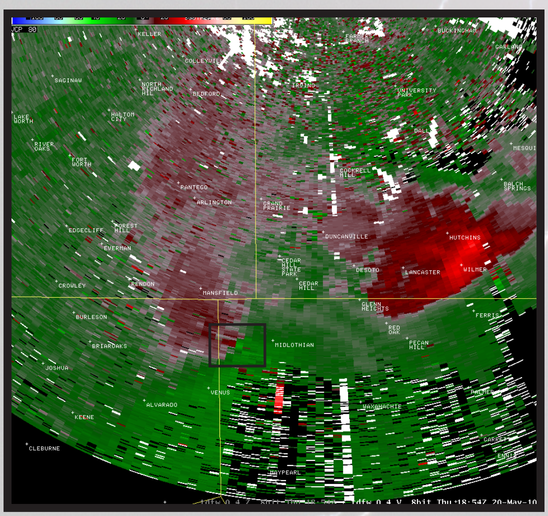
How Does Doppler Radar Help Meteorologists Detect Tornadoes?

Continued

It is important to know that the NEXRAD system rarely "sees" the actual tornado. Instead, it usually samples the strong, associated circulation. This is why a tornado warning can be issued and no tornado actually develops. There may be strong rotation within the thunderstorm, but it may never produce a tornado.

In other cases, there may not be strong rotation, but there may be a tornado. These are the hardest cases for meteorologists to identify in real-time because the radar signature is not that strong. This was the case with the Midlothian, TX tornado on May 20, 2010.



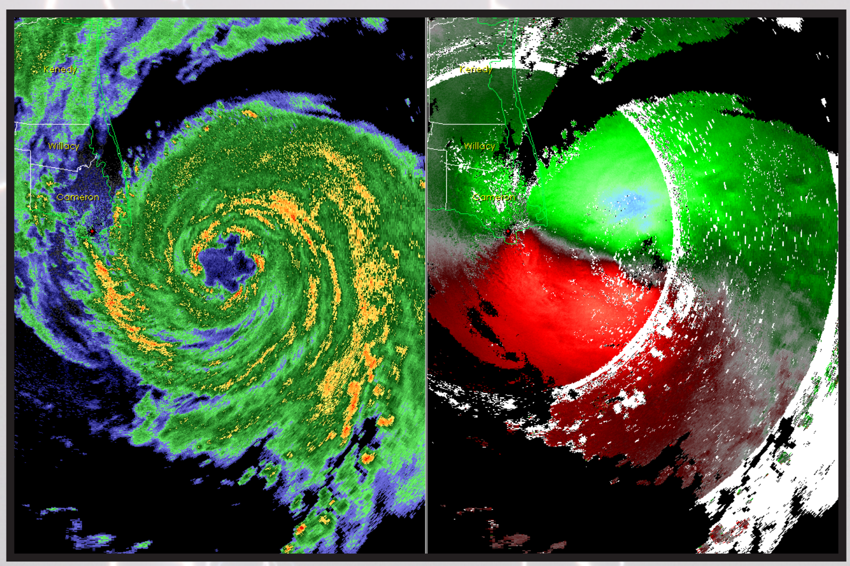


Above:
Radar images from the Love Field Terminal Doppler radar (TDAL) on May 20, 2010. The top image is reflectivity and the bottom image is velocity.

In the top image to the left (from the Dallas Love Field Terminal Doppler radar), there is a weak hook signature west of Midlothian in the reflectivity. Note the area of interest is highlighted in the box. The bottom image to the left, which is the velocity or wind speed, shows a very small area of green colors next to red colors. This is an area of rotation associated with the small tornado.

Doppler radar is not only used for tornado detection, but can also be used to estimate wind speeds with a landfalling hurricane. Hurricane Dolly is shown in the image below offshore from the Texas coast. The image on the left shows the precipitation and the well-defined eye, while the image on the right shows the wind speeds associated with the hurricane.

Doppler radar is one of the many tools used by meteorologists during severe weather. Storm spotters are also very helpful in relaying critical information about a storm's intensity back to the forecasters.



Above:
Radar images from Hurricane Dolly approaching the south Texas coast on July 23, 2008. The image on the left is reflectivity. Image on the right is velocity.

Want to Know More on Radar and the NEXRAD System?
www.srh.noaa.gov/srh/jetstream/doppler/doppler_intro.htm